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March 15, 2005

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**Certificate**  
**MAR 22 2005**  
**of Correction**

Re: U.S. Patent No.: 6,859,499 B2  
Issued: February 22, 2005  
Inventor: Hashimoto  
Our Docket: 33857

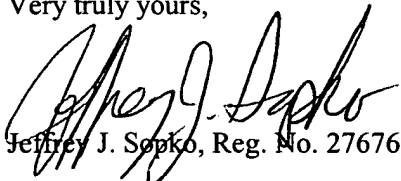
Sir:

A Certificate of Correction under 35 U.S.C. 254 is hereby requested to correct Patent Office printing errors in the above-identified patent. Enclosed herewith is a proposed Certificate of Correction (Form No. PTO-1050) for consideration along with appropriate documentation supporting the request for correction.

It is requested that the Certificate of Correction be completed and mailed at an early date to the undersigned attorney of record. The proposed corrections are obvious ones and do not in any way change the sense of the application.

We understand that a check is not required since the errors were on the part of the Patent and Trademark Office in printing the patent.

Very truly yours,

  
Jeffrey J. Sopko, Reg. No. 27676

JJS:vlh  
Enclosures

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date indicated below.

Jeffrey J. Sopko

Name of Attorney for Applicant(s)

March 15, 2005

Date

  
Signature of Attorney

MAR 23 2005

**UNITED STATES PATENT AND TRADEMARK OFFICE  
CERTIFICATE OF CORRECTION**

PATENT NO. : 6,859,499 B2  
DATED : February 22, 2005  
INVENTOR(S) : Hashimoto

PAGE 1 OF 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1

Line 39, please delete "(3)}+φ{g93)-g(4)}" and insert therefor --(3)}+φ{g(3)-g(4)}--.

Column 1

Line 43, please delete "(5)-g(6)-g(7)}" and insert therefor --(5)-g(6)}+φ{g(6)-g(7)}--.

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PATENT NO. 6,859,499 B2

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MAR 23 2005



## DEBLOCKING FILTERING APPARATUS AND METHOD

### Background of the Invention

The present invention relates to the processing performed  
5 for a recovered image during a digital image compression process,  
and relates in particular to a deblocking filtering apparatus  
and method defined in MPEG-4.

For the processing of digital images, the internationally  
accepted MPEG digital image compression standards provide  
10 for the employment of a discrete cosine transform. This is  
an irreversible transform used for quantization, and depending  
on the condition of an original image, a phenomenon occurs  
whereby a pseudo outline having a block shape (block noise),  
which is inherent to the system, may appear in a recovered  
15 image.

As a countermeasure, Vertification Model 7.0 of the MPEG-4  
video standards defines a deblocking filter as a post process  
for a recovered image. As is shown in Fig. 3, the defined  
deblocking filter performs filtering for ten received pixel  
20 values positioned around the block boundary, and outputs eight  
pixel values positioned around the block boundary. Two types  
of operation modes, a DC offset mode operation (hereinafter  
referred to as a Dmode operation) and a default mode operation,  
are switched in accordance with a change value (hereinafter  
25 referred to as an activity) for the value of a pixel near

the block boundary. An evaluation function representing the activity employs the following equation (1).

$$f = \phi\{g(0)-g(1)\} + \phi\{g(1)-g(2)\} + \phi\{g(2)-g(3)\} + \phi\{g(3)-g(4)\} \\ + \phi\{g(4)-g(5)\} + \phi\{g(5)-g(6)\} + \phi\{g(6)-g(7)\} \\ + \phi\{g(7)-g(8)\} + \phi\{g(8)-g(9)\}$$

where

$$\begin{aligned} \text{if } (\text{abs}(x) \leq \text{Th1}) \quad & \phi(x) = 1; \\ \text{else} \quad & \phi(x) = 0 \end{aligned} \quad . . . (1)$$

According to an evaluation function  $f$  in equation (1),  
 10 for ten pixel values positioned around a block boundary, an absolute differential value for the difference between adjacent pixel values is compared with a threshold value  $\text{Th1}$ , and a count is acquired of the locations whereat the absolute differential value is equal to or smaller than the threshold value  $\text{Th1}$ . If the value of the evaluation function  $f$  is equal  
 15 to or greater than a threshold value  $\text{Th2}$ , i.e., when the activity is low, the D mode operation is selected. But if the value of the evaluation function  $f$  is smaller than the threshold value  $\text{Th2}$ , i.e., when the activity is high, the default mode  
 20 operation is selected.

A more effective smoothing process is performed for a Dmode operation than is performed for a default mode operation, as is illustrated by an operation equation (2) that is shown below. The smoothing process is performed if the absolute  
 25 differential value between a maximum pixel value and a minimum